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ENGINEERING-SCIENCE, INC.**FACSIMILE TRANSMISSION**

TOTAL PAGES: 9 PROPOSAL/PROJECT NO.: 722446 22014
ATTENTION: Dave Ericson CITY/STATE: Golden CO
COMPANY NAME: EG&G
TELECOPY NO.: () 966-8768
FROM: Phil Nixon DATE: June 24, 1994
SUBJECT/REFERENCE: No-Action Risk data
RECEIVING OFFICE - SPECIAL INSTRUCTIONS:

- ☒ DELIVER TO: Dave Ericson
☐ RESPONSE DUE: _____
☐ COPY AND DISTRIBUTE TO: _____

MESSAGE:

Enclosed is risk data for
chemicals under the no-action
Alternative 1.5×10^{-3} (cancer) which does
not include radionuclides. Hazard
index 47.5 (noncancer). Our
goal 1.0×10^{-6} (cancer) and
Hazard Index should be 1.

ES-1-12

ADMIN RECORD

IA-A-000794

CEX-072 99

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The following tables present the carcinogenic and noncarcinogenic risks associated with the no action alternative at OU4, Rocky Flats Site for surficial soils. The total hazard index (the sum of the noncarcinogenic hazard quotients) for surficial soils is 47.5, much greater than EPA's threshold of 1. Risk Assessment Guidance for Superfund (RAGS) states "when the hazard index exceeds unity, there may be a concern for potential health effects." The total cancer risk under the no action alternative is calculated to be approximately $1.5E-3$, a much higher probability than the EPA accepted range of 10^{-5} to 10^{-7} . Note that these calculations were based on the assumption that air concentrations of the COCs are negligible under the no action alternative. Radionuclide concentrations were also not incorporated into these estimates, therefore the calculations should be evaluated accordingly.

File R1E2RISK
Risk Calculations for Surface Soil
OUA, Solar Evaporation Ponds, IM/TRA
Rocky Flats Plant, Golden, Colorado

Constituent of Concern	Risk Assessment Concentration (mg/kg)	RD oral ^a (mg/kg-day)	R/C Inhal (mg/cu m) ^b	R/C Inhal ^b (mg/kg-day)	RD derm ^c (mg/kg-day)	SF (oral) ^d 1/(mg/kg-d)	SF (inhl) 1/(ug/cu m)	SF (inhl) ^b 1/(mg/kg-d)	SF (derm) ^e 1/(mg/kg-day)
Aroclor 1254	3.2514	7.00E-05			6.30E-05	7.70E+00			8.56E+00
Benzo(a)anthracene	0.83029					7.30E-01			5.30E+00
Benzo(a)pyrene	0.88144					7.30E+00	6.10E+03	2.14E+07	3.65E+01
Benzo(b)fluoranthene	0.37131					7.30E-01			3.65E+00
Benzo(g,h)perylene	0.65734								
Benzo(k)fluoranthene	0.4225								
Beryllium	3.98	5.00E-03				7.30E-02			3.65E-01
Bis(2-ethylhexyl)phthalate	8.12991	2.00E-02			5.00E-05	4.30E+00	2.40E-03	8.40E+00	4.00E-02
Cadmium	172.1	1.00E-03			1.00E-02	1.40E-02			2.80E-02
Chrysene	0.9461				2.00E-05	7.30E-03	1.80E-03	6.30E+00	
Di-n-butyl phthalate	0.71318	1.00E-01			5.00E-02				5.35E-02
Fluoranthene	0.37458	4.00E-02			8.00E-03				
Indeno(1,2,3-cd)pyrene	0.71254					7.30E-01			3.65E+00
Mercury	0.17	3.00E-04	3.00E-04	8.57E-05	3.00E-06				
Nitrate	595.62	1.60E+00			3.20E-01				
Phenanthrene	0.38155								
Pyrene	0.38604	3.00E-02			6.00E-03				
Silver	2.19	5.00E-03			2.50E-03				

*NOTE -

AT = Average Time (days)
 BW = Body Weight (kg)
 EF = Exposure Frequency (days/yr)
 ED = Exposure Duration (yr)
 CF = Conversion Factor (kg/mg)
 IR soil = Soil Ingestion Rate (mg/day)
 IR air = Air Inhalation Rate (m³/day)
 SA = Exposed Surface Area of Body (cm²)
 AB = Absorption Factor (unitless)
 AF = Adherence Factor (mg/cm²/event)

R1E2RISK

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File E1 E2R ISK

**Risk Calculations for Surficial Soil
OU4, Solar Evaporation Ponds, IM/TXA
Rocky Flats Plant, Golden, Colorado**

Contaminant of Concern	AT (days)		child (days)	adult (days)	adult child (kg)	EF (days/yr)	adult (yr)	child (yr)	CF (kg/mg)	soil adult		soil child		air adult		air child		AF (mg/cm ² /event)
	(days)	(days)								(mg/day)	(mg/day)	(m ³ /day)	(m ³ /day)	(cm ³)	(cm ³)			
Aroclor 1234	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.5	1	
Benzo(a)anthracene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Benzo(a)pyrene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Benzo(b)fluoranthene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Benzo(g)herylene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Benzo(k)fluoranthene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Beryllium	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.01	1	
Bis(2-ethylhexyl)phthalate	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Cadmium	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.01	1	
Chrysene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Di-n-butyl phthalate	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Fluoranthene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Indeno(1,2,3-cd)pyrene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Mercury	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.01	1	
Nitrate	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.01	1	
Phenanthrene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Pyrene	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.25	1	
Silver	25550	2190	8760	70	15	350	24	6	1.00E-06	100	200	20	18	7100	4600	0.01	1	

NOTE -

AT = Average Time (days)
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ED = Exposure Duration (yr)
CF = Conversion Factor (kg/mg)
IR_{soil} = Soil Ingestion Rate (mg/day)
IR_{air} = Air Inhalation Rate (m³/day)
AA = Exposed Surface Area of Body (cm²)
AF = Absorption Factor (unitless)
AP = Adherence Factor (mg/cm²/event)

RESULTS

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File H1E2RISK
Risk Calculations for Surficial Soil
OU4, Solar Evaporation Ponds, IM/JRA
Rocky Flats Plant, Golden, Colorado

Contaminant of Concern	NONCARCINOGENIC HQs				Dermal				Total	
	Ingestion	Child	Adult	Combined	Inhalation	Child	Adult	Combined	Noncarcinogenic	HQ
Aroclor 1254	6.36E-02	5.94E-04	6.57E-01	-	-	-	2.51E+00	7.99E+00	1.01E+01	1.08E+01
Benzo(a)anthracene	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-
Benzo(g,h)perylene	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-
Beryllium	1.09E-03	1.02E-02	1.13E-02	-	-	-	7.74E-02	2.34E-01	3.11E-01	3.23E-01
Bis(2-ethylhexyl)phthalate	5.57E-04	5.20E-03	5.75E-03	-	-	-	1.98E-02	5.98E-02	7.95E-02	8.33E-02
Cadmium	2.36E-01	2.20E+00	2.44E+00	-	-	-	8.37E+00	2.53E+01	3.37E+01	3.61E+01
Chrysene	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	9.77E-06	9.12E-05	1.01E-04	-	-	-	3.47E-04	1.05E-03	1.40E-03	1.50E-03
Fluoranthene	1.28E-05	1.20E-04	1.33E-04	-	-	-	1.14E-03	3.44E-03	4.58E-03	4.71E-03
Isodao(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-
Mercury	7.26E-04	7.25E-03	8.02E-03	0.00E+00	-	-	5.51E-02	1.67E-01	2.22E-01	2.30E-01
Nitrate	5.80E-04	4.26E-03	5.27E-03	-	-	-	1.81E-03	5.47E-03	7.28E-03	1.26E-02
Phenanthrene	-	-	-	-	-	-	-	-	-	-
Pyrene	1.76E-05	1.65E-04	1.82E-04	-	-	-	1.56E-03	4.73E-03	6.29E-03	6.48E-03
Silver	6.00E-04	5.60E-03	6.20E-03	-	-	-	8.52E-04	2.58E-03	3.43E-03	9.63E-03

***NOTE -**

AT = Average Time (days)
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 IR soil = Soil Ingestion Rate (mg/day)
 IR air = Air Inhalation Rate (m³/day)
 SA = Exposed Surface Area of Body (cm²)
 AB = Absorption Factor (unitless)
 AF = Adherence Factor (mg/cm²/event)

R1E2RISK

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File E1E2RISK
Risk Calculations for Surficial Soil
OU4, Solar Evaporation Ponds, IM/RA
Rocky Flats Plant, Golden, Colorado

Contaminant of Concern	Cancer Risks Ingestion			Inhalation			Dermal			TOTAL CANCER RISKS
	Adult	Child	Combined	Adult	Child	Combined	Adult	Child	Combined	
Aroclor 1254	1.18E-05	2.74E-05	3.92E-05	-	-	-	4.64E-04	3.51E-04	8.15E-04	9E-04
Benzo(a)anthracene	2.85E-07	6.64E-07	9.49E-07	-	-	-	3.67E-05	2.77E-05	6.44E-05	7E-05
Benzo(a)pyrene	3.02E-06	7.05E-06	1.01E-05	0.00E+00	0.00E+00	-	2.68E-04	2.08E-04	4.71E-04	5E-04
Benzo(b)fluoranthene	1.27E-07	2.97E-07	4.24E-07	-	-	-	1.13E-05	8.54E-06	1.98E-05	2E-05
Benzo(g,h)perylene	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	1.45E-08	3.38E-08	4.83E-08	-	-	-	1.29E-06	9.72E-07	2.26E-06	2E-06
Beryllium	8.04E-06	1.88E-05	2.68E-05	0.00E+00	0.00E+00	-	5.31E-08	4.01E-08	9.32E-08	3E-08
Bis(2-ethylhexyl)phthalate	5.35E-08	1.25E-07	1.78E-07	-	-	-	1.90E-06	1.43E-06	3.33E-06	4E-06
Cadmium	-	-	-	0.00E+00	0.00E+00	-	-	-	-	-
Chrysene	3.24E-09	7.57E-09	1.08E-08	-	-	-	4.22E-07	3.19E-07	7.41E-07	8E-07
Di-n-butyl phthalate	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	2.44E-07	5.70E-07	8.14E-07	-	-	-	2.17E-05	1.64E-05	3.81E-05	4E-05
Mercury	-	-	-	-	-	-	-	-	-	-
Nitrate	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-

*NOTE -

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ED = Exposure Duration (yr)

CF = Conversion Factor (kg/mg)

IR soil = Soil Ingestion Rate (mg/day)

IR air = Air Inhalation Rate (m³/day)SA = Exposed Surface Area of Body (cm²)

AB = Absorption Factor (unitless)

AF = Adherence Factor (mg/cm²/event)Total Cancer
Risks

0.0014929815

E1E2RISK

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File E5E6RISK
Risk Calculations for Vadose Zone Soils
OU-4, Solar Evaporation Ponds, IMARA
Rocky Flats Plant, Golden, CO

Contaminant of Concern	RA Conc (mg/kg)	Modeled Air Conc (mg/kg)	RII oral (mg/kg-day)	RII Inhal (mg/kg-day)	RII derm (mg/kg-day)	SF (oral) $1/(mg/kg-day)$	SF (inhal) $1/(ug/cu m)$	SF (derm) $1/(mg/kg-day)$
Acetone	0.06992	0	1.00E-01	5.00E-04	9.00E-02			
Barium	108.4	0	7.00E-02	1.43E-04	3.50E-03			
Bis(2-ethylhexyl)phthalate	0.22	0	2.00E-02		1.00E-02			
2-Butanone	0.029	0	6.00E-01	1.00E+00	5.40E-01			2.80E-02
Cadmium	163.06	0	1.00E-03		2.00E-05			
Chloroform	0.0225	0	1.00E-02		1.00E-02			
Cyanide	15.93	0	2.00E-02		1.00E-02			
Di-n-butyl phthalate	0.22	0	1.00E-01		1.00E-01			
Lithium	14.26	0						
Manganese	238.92	0	5.00E-03	4.00E-04	5.00E-05			
Methylene chloride	0.03036	0	6.00E-02	3.00E+00	5.88E-02			
Nitrate/Nitrite	1873.4	0	1.00E+00		3.20E-01			
Strontium	0.275	0	6.00E-01		6.00E-03			
Toluene	0.2119	0	2.00E-01	4.00E-01	1.80E-01			
Zinc	4.74	0	3.00E-01		3.00E-03			

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Contaminant of Concern	Carc		Noncarc	
	AT (days)	AF (mg/cm ² /even)	AT (days)	AF (mg/cm ² /even)
Acetone	25550	70	480	20
Barium	25550	70	480	20
Bis(2-ethylhexyl)phthalate	25550	70	480	20
2-Butanone	25550	70	480	20
Cadmium	25550	70	480	20
Chloroform	25550	70	480	20
Cyanide	25550	70	480	20
Di-n-butyl phthalate	25550	70	480	20
Lithium	25550	70	480	20
Manganese	25550	70	480	20
Methylene chloride	25550	70	480	20
Nitrate/Nitrite	25550	70	480	20
Strontium	25550	70	480	20
Toluene	25550	70	480	20
Zinc	25550	70	480	20

NOTE -

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ED = Exposure Duration (yr)

CF = Conversion Factor (kg/mg)

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IR air = Air Inhalation Rate (m³/day)SA = Exposed Surface Area of Body (cm²)

AB = Absorption Factor (unitless)

Contaminant of Concern	RISK CALCULATIONS NONCARCINOGENIC HQ's			CARCINOGENIC RISKS			TOTAL CANCER RISK
	Ingestion	Inhalation	Dermal	Total Noncarcinogenic HQ	Ingestion	Inhalation	
Acetone	7.88E-07	-	8.57E-07	1.65E-06	-	-	-
Barium	1.75E-03	0.00E+00	3.42E-03	5.16E-03	-	-	-
Big(2-ethylhexyl)phthalate	1.24E-05	-	6.07E-05	7.31E-05	4.96E-10	-	-
2-Butanone	5.45E-08	0.00E+00	5.93E-08	1.14E-07	-	-	3E-09
Cadmium	1.84E-01	-	9.00E-01	1.08E+00	-	-	-
Chloroform	1.41E-06	-	1.38E-06	2.79E-06	1.23E-11	0.00E+00	-
Cyanide	8.98E-04	-	1.76E-04	1.07E-03	-	-	2E-11
Di-n-butyl phthalate	2.48E-06	-	6.07E-06	8.55E-06	-	-	-
Lithium	-	-	-	-	-	-	-
Manganese	5.39E-02	0.00E+00	5.27E-01	5.81E-01	-	-	-
Methylene chloride	5.74E-07	0.00E+00	5.74E-07	1.15E-06	3.69E-11	0.00E+00	-
Nitrate/Nitrite	1.32E-03	-	3.23E-02	3.36E-02	-	-	7E-13
Strontium	5.17E-07	-	5.06E-06	5.58E-06	-	-	-
Toluene	1.19E-06	0.00E+00	1.30E-06	2.49E-06	-	-	-
Zinc	1.78E-05	-	1.74E-04	1.92E-04	-	-	-
Total HI				1.71	Total Cancer Risks		3.02E-09

*NOTE -

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